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Stochasticity ensure efficiency AGRICULTURAL MACHINES

IL Rogovskiy, Ph.D.

In the article the methodical approach to the description of stochastic ensure the efficiency of agricultural machinery.

The efficiency of a car, and stochasticity.

Problem. The production process of maintenance of agricultural machinery is a stochastic process, since the length and the fact of the necessity of work are random. Readability maintenance, a significant difference in their performance trudoyemkosti, no clear relationship between technological and economic feasibility work to limit the number of performers (resources) make use of methods of network planning and management of the construction process optimization and maintenance of machines.

Analysis of recent research. Methods of network planning and management is one of the sections of the graph theory. It was widely used in the industry both in our country and abroad, helped research vchnenyh Holenko DI, Razumikhina BS, N. Beck, Kelly Clark, Levi.

Analysis methods of network planning and management allows to state that the correct construction process maintenance machines can be realized if they considered the conditions of work [1], mechanization [2], the number of performers [3], the probability and duration of necessary works [4], coherence and consistency artists works, the number of performers and distribution of work between them according to their skills and importance of work performed [5].

The purpose of research. Theoretical background optimization sequence of maintenance with limited resources.

Results. An important characteristic of the production process maintenance must consider the length of maintenance t_{TO} That depends on a number of factors that can be grouped into three categories: trudoyemkist maintenance; number of performers; consistency of performance.

In general, because of the nature of probabilistic feature full length maintenance is the law of distribution:

$$F(t) = P[t_{TO} < t],$$

where $P[t_{TO} < t]$ - The likelihood that the length is greater than some value t and $t_{TO} \geq 0$.

Each number plate is for maintenance (number) work, the complexity and number of which increases from room to room maintenance.

As for maintenance work includes works that are performed when necessary and captured repetition factor k, Then:

$$\left.\begin{array}{c} N_{\phi} = N_p + k \cdot N_u, \quad 0 \le k \le 1 \\ npu \quad k = 1 \quad N_{\phi} = N \end{array}\right\},$$

where N - The amount of work;

$\phi, \quad p, \quad u$ - Index, which marked the work performed, respectively, actual, routine and necessary.

Policymakers duration of maintenance t_{TO}^{∂} defined by the expression:

$$t_{TO}^{\partial} = \frac{T_{TO}}{z},$$

where T_{TO} - Trudoyemkist maintenance; z - The number of performers.

Directive ignores duration prolongation of maintenance due to uncoordinated actions and the need for artists works in a certain sequence, ie, $t_{TO}^{\partial} \le t_{TO}$ While the ratio $\frac{t_{TO}^{\partial}}{t_{TO}} = k_{on}$ will be of optimum process MOT $(k_{on} \le 1)$. The need for compliance with safety, convenience and quality maintenance makes maintenance works in a certain sequence, you can:

- Ensure maximum load and performance of both performers and mechanization;
- Reduce machine downtime, subject to maintenance, artists and mechanization.
- Clearly agree action performers.
- Exclude inefficient use of maintenance.

The analysis work that lead to the maintenance process, revealed the following limited describing the interdependence of these works:

- o restrictions imposed by the need to comply with safety standards;
- o restrictions that take into account the quality and convenience of works;
- o constraints defined equivalence since the beginning of the work.

Subject to the above restrictions have been established between these operating depending works on:

- o Rods work sequence of which is obvious to form a continuous sequence since the start of the production process;
- o Works with full hard links that exclude simultaneous (parallel) production of any other work on the tractor;

o Work hard bond, the start of production which excludes the possibility of the second work at this site or at a given location.

o Works with free communications, the implementation of which does not limit the ability of the second production activities;

o Works with partial free communication, in the course of which may be established short-term suspension of production or inconvenience others work;

o Works on cell communication, which include an element of "waiting" and can be made at any time after the "waiting".

o The presence of dependencies between operational causes a parallel or serial works.

Considering the above, the duration of maintenance should be determined by the expression:

$$t_{TO} = \max \sum_{1}^{i} \frac{t_i}{z_i} + \sum_{1}^{j} \frac{t_j}{z_j}. \quad (1)$$

Considering the repetition factor k and probability P the duration of the work equation (1) takes the form:

$$t_{TO} = \max \sum_{1}^{i} \left(\frac{t_{p_i}}{z_{p_i}} + k_i \cdot P_i \cdot \frac{t_{ui}}{z_{ui}} \right) + \sum_{1}^{j} \left(\frac{t_{p_j}}{z_{p_j}} + k_j \cdot P_j \cdot \frac{t_{uj}}{z_{uj}} \right),$$

where i, j - Index, which marked the work performed, respectively, serial and parallel ways.

In the distribution of work between the performers at the possible options are: nodal maintenance; Then signs (nature) of work performed; areas for the location of points of maintenance; mixed arrangement works. When choosing an organizational scheme you should consider the qualifications of, the importance of the work and satisfy the conditions:

$$\left. \sum_{1}^{z} t_{np} \to 0; \quad t_з^1 = t_з^2 = \ldots = t_з^z \right\},$$
$$t_{TO} \to t_{TO}^{\partial}$$

where t_{np}, $t_з$ - Consequently, downtime and employment performers.

On the basis of complexity of the work found that the importance of work-1 and-2 defined in points based on the importance of maintenance units (Table. 1).

1. Assessment of the significance of works on-1 and-2.

Exhaust systems and	Scores	Type of works maintenance

components	units, systems and components $Б_{з.р.}$	Washer-treatment	Verification Review	filling	lubricants	Control and Adjustment-tional
		Points by type $Б_{х.р.}$				
Engine, electrical system	5	6	7	8	9	10
Transmission and its hydraulic system	4	5	6	7	8	9
Chassis System	3	4	5	6	7	8
Hydraulic system and attached device	2	3	4	5	6	7
Starting the engine, radiator, fuel tanks, etc.	1	2	3	4	5	6

Evaluation of score $Б_p$ defined by the expression:

$$Б_p = Б_{х.р.} + Б_{з.р.}.$$

Works by artist fixed as follows:

- for the master $2 \le Б \le 10$;
- Assistant wizard $2 \le Б \le 7$;
- for tractor $2 \le Б \le 6$.

In recent years, widely spread problem solving optimization of network models using statistical test method and the method of random search, which have the advantage.

First, analizuyeme pidmnozhynnist limited options selected at random and allows a more uniform choice.

Second, with the increasing number rozhlyadayemyh options increases the likelihood of obtaining optimal solution.

Thirdly, ymovirnysnyy character sorting options allow statistically assess the extent of the deviation of the best reviewed of optimal solutions.

Volume calculation increases with the number of works in the networking model that can be attributed to the shortcomings of this method. Considering also that some work inherent ymovirnysnyy, not only the duration but also because of the very fact of their implementation, phased optimization algorithm is proposed sequence of work. The idea of the algorithm lies in the fact that at the time pershopochakovyy method of network models, then using statistical tests take into account the probable duration of the nature of the work; the third stage of the optimization time of work, taking into account the restrictions imposed by resource constraints. This approach to the solution of the problem can reduce the computing time in the program on the PC.

Using the known development Holenko DI and Razumikhina BS can thus in general form mathematically formulated optimization problem maintenance process.

The process of maintenance, which is represented in a graph consists of $(n+1)$ events $e, e_1, ..., e_n$ and works $q_{ij}(i<j)$. Size $z_{ij}(t)$ describes the number of artists participating in the performance of q_{ij} at the time t. Each work q_{ij} corresponds to the number of resource time Q_{ij} Which is required to perform this work:

$$Q_{ij} = \int_{t_i}^{t_j} z_{ij}(t)dt ,$$

where t_i, t_j - Times of beginning and end of q_{ij} Which coincide with the point in time of receipt of events e_i and e_j.

For work package N a certain amount of resources available M That can enforce any of the works q_{ij}:

$$N = N_1 + N_2 + ... + N_k; \quad M = M_1 + M_2 + ... + M_k . \qquad (2)$$

When a plurality of works $q_{ij} \in N_s$ consists of works that may be made of resources that meet pidmnozhynnosti M_s. Then the function $z_{ij}^{(s)}(t)$Which satisfies $\int_{t_i}^{t_j} z_{ij}^{(s)}(t)dt = Q_{ij}^{(s)}$ is a function of resource allocation in the multiplicity M_s in the time interval (t_i, t_j) duration of work $q_{ij} \in N_s$.

Thus, the function in question $z_{ij}^{(s)}(t)$ satisfies, in addition to condition (2) conditions:

$$z_{ij}^{(s)}(t) = \{ \begin{matrix} \equiv 0 & npu & t \le t_i \\ \ge 0 & npu & t_i \le t \le t_j \\ \equiv 0 & npu & t > t_j \end{matrix} .$$

Number of resources by plurality M_s Used at time t Is expressed by the function:

$$z^{(s)}(t) = \sum_{q_{ij} \in N_s} z_{ij}^{(s)}(t) .$$

Re-distribution of work between artists $q_{ij} \in N_s$ occurs at time $t_0, t_1, ..., t_{n-1}, t_n$ the event $e_0, e_1, ..., e_{n-1}, e_n$.

This suggests:

$$z_{ij}^{(s)}(t) = z_{ij}^{(s)}(t_k + 0) = z_{ij}^{(s)}(t_{k+1} - 0) \text{ at } t_k < t < t_{k+1} \quad (k = 0, 1, ..., n-1).$$

This condition takes the form:

$$\sum_{k=1}^{j=1} (t_{k+1} - t_k) z_{ij}^{(s)}(t_k + 0) = Q_{ij}^{(s)} . \qquad (3)$$

The problem of optimal allocation of resources is reduced to a function definition $z_{ij}^{(s)}(t)$Which satisfies the conditions (3), that is, to determine the function for which achieved minimum functionality:

$$I^{(s)} = \int_{t_0}^{t_n} \left(z^{(s)}(t) - L_s\right)^2 dt .$$

As a permanent L_s accepted:

$$L_s = \frac{1}{t_n - t_0} \int_{t_0}^{t_n} z^{(s)}(t) dt = \frac{\sum\limits_{q \in N_s} Q_{ij}^{(s)}}{t_n - t_0} .$$

Conclusion

The main drawbacks must include the following.

The lack of scientifically based methods of construction process maintenance and rational method for determining the number of performers and distribution of work between their coordination skills and the importance of work.

The empirical formula of the service time does not include the impact of coherence and consistency artists perform maintenance.

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In this article solved methodical Approach for Description stochasticity Provision rabotosposobnosty agricultural machines.

Rabotosposobnost, Car, stochasticity.

In paper the methodical approach to description of stochastic ensure efficiency of agricultural machinery.

Efficiency, machine, Stochastics.

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AVAILABILITY FACTOR OF FOREST MEW

LL Titov, graduate student *

The paper presents results on the methodological regulations describing mathematical model to ensure availability factor of forest MEW.

Means, availability factor, forest MEW.

Problem. Since forest equipment is characterized by low reliability, and foreign counterparts are not available because of the high cost for forestry

* Supervisor - Ph.D. IL Rogovskiy

producers, farmers have worn operate machinery. Level spratsovanosti reached 65-80%.

Analysis of recent research. About 80 percent of the available forest Ukraine MEW worked depreciation period [1] and be written off [2], but continue to be used [3]. The gradual drop in the reliability of this technique has a negative impact on the effluent of logging operations and leads to higher costs [4].

The purpose of research. For the purpose of further use, studies of failures and malfunctions forest MEW as those that worked depreciation period, in a real operation. As a result, it was found in nature and main causes of failures, the main reliability. But it is necessary to perform an assessment of the reliability indices laws establishing their distribution.

Results. In this paper, has been tasked to perform a safety assessment of forest MEW that worked amortization period for the composite index (coefficient of readiness) in two ways: analytically and by cultivation statistics.

Consider readiness assessment factor using tabulated distribution functions through a simple ratio, defined as:

$$K_П = 1 - K_Г = \frac{T_в}{T_о + T_в}, \tag{1}$$